

ONTARIO. MINISTRY OF THE ENVIRONMENT

A report on the status of Three Mile
Lake (Hodson Lake) Armour Township,
Parry Sound District.

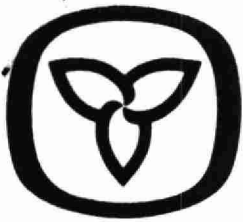
April 1972.

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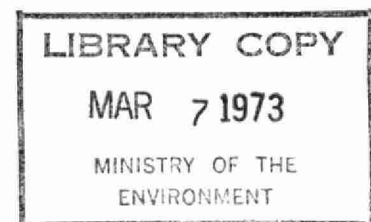
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Environment Ontario

A REPORT ON THE STATUS OF
THREE MILE LAKE (HODSON LAKE),
ARMOUR TOWNSHIP,
PARRY SOUND DISTRICT

D. J. BROWN
BIOLOGY SECTION
APRIL 1972



INTRODUCTION

Over the past few years an increasing awareness and concern for problems of pollution in recreational lakes have materialized as a consequence of accelerated cottage development. Many individual cottagers, cottage associations' and permanent shoreline residents have requested that complete water quality evaluations be carried out to assess the degree of pollution in lakes. Exhaustive physical, chemical, bacteriological and biological evaluations for a large number of lakes are beyond the financial and logistical capabilities of personnel involved in water management programmes, and in light of recent studies, are not necessary in order to categorize the quality of recreational waters. In 1971, a practical but effective evaluation programme was carried out on thirteen recreational lakes in the Province of Ontario.

The programme, which involved the collection of data on water clarity and algal populations was highly successful owing to the enthusiastic efforts of local residents, cottagers, marina and resort owners and personnel of the Ministries of Natural Resources and the Environment.

METHODS

Secchi disc readings and chlorophyll samples were taken weekly or as often as possible. The Ministry of the Environment (formerly OWRC) gratefully acknowledges the assistance of persons involved in the collection of water samples from Three Mile Lake.

Secchi disc measurements were made by lowering the disc into the water on the shaded side of the boat and recording the depth at which the alternating black and white quadrants just disappeared. The disc was then lowered a short distance and raised slowly until the black and white segments were again visible. A second reading was then taken. A mean of the two readings was the Secchi disc depth.

Chlorophyll samples were taken by lowering a 32-ounce bottle provided with a restricted opening to the approximate location of the 1% incident light level determined as twice the Secchi disc. The sample was immediately preserved with 10-15 drops of a 2% magnesium carbonate suspension and rapidly transported to the laboratories in Toronto for analysis.

SIGNIFICANCE OF CHLOROPHYLL a AND SECCHI DISC

Chlorophyll a measures the amount of photosynthetic green pigment in algae while the Secchi disc determines water transparency. Thus, the amount of chlorophyll and corresponding Secchi disc depths can be used to reflect the degree of aquatic enrichment in a lake at the time of sampling. Chlorophyll levels as well as Secchi disc depths do not remain constant through the summer months but fluctuate due to environmental factors (physical, chemical and biological). For example, the highest chlorophyll values and lowest Secchi disc readings are generally expected in early spring as well as in August through early September.

The chlorophyll a test is limited to a degree, as concentrations less than 2.0 $\mu\text{g/l}$ are below the lower analytical limit of the test. Values in the 2.0 - 5.0 $\mu\text{g/l}$ range are low and indicate low to moderate algal populations. Concentrations between 5.0 and 10.0 $\mu\text{g/l}$, although moderately high, may be considered acceptable for most water-oriented recreational pursuits. Levels between 10.0 and 15.0 $\mu\text{g/l}$ reflect high algal levels and greater than 15 $\mu\text{g/l}$ indicates nuisance levels of algae. At these higher levels; severe degradation of recreational activities will result as well as the retardation of aesthetic water quality.

RESULTS AND DISCUSSIONS

The chlorophyll a concentrations and Secchi disc values collected from Three Mile Lake during 1971 are presented in Table 1. Based on the five samples submitted, chlorophyll values for the lake were generally below the analytical lower limit of the test and correspondingly reflect low algal densities. Some caution should be exercised when interpreting the results as spring and early summer data which could influence final judgements relating to the enrichment status of the lake were not collected.

The data collected were incorporated into a curve (Figure 1) representing a mathematical relationship for 945 sets of chlorophyll a - Secchi disc values collected from approximately sixty recreational lakes, located primarily in Southern Ontario (Brown 1972). Three Mile Lake was positioned between the oligotrophic to mesotrophic Lake Ontario and the Eastern Basin of Lake Erie, and the oligotrophic Lakes Superior, Huron and Joseph. The lake was well-removed from the extremely productive waters of Gravenhurst Bay, Riley Lake and Bay of Quinte. The relative position of Three Mile Lake reflects the oligotrophic nature of the lake.

Property owners and cottagers should be aware that unless artificial nutrients are kept from gaining access to the lake, future water quality will most certainly be undermined. In this connection every effort should be made to ensure that nutrients from sink and laundry wastes, as well as seepage from septic tank systems do not gain access to the lakes.

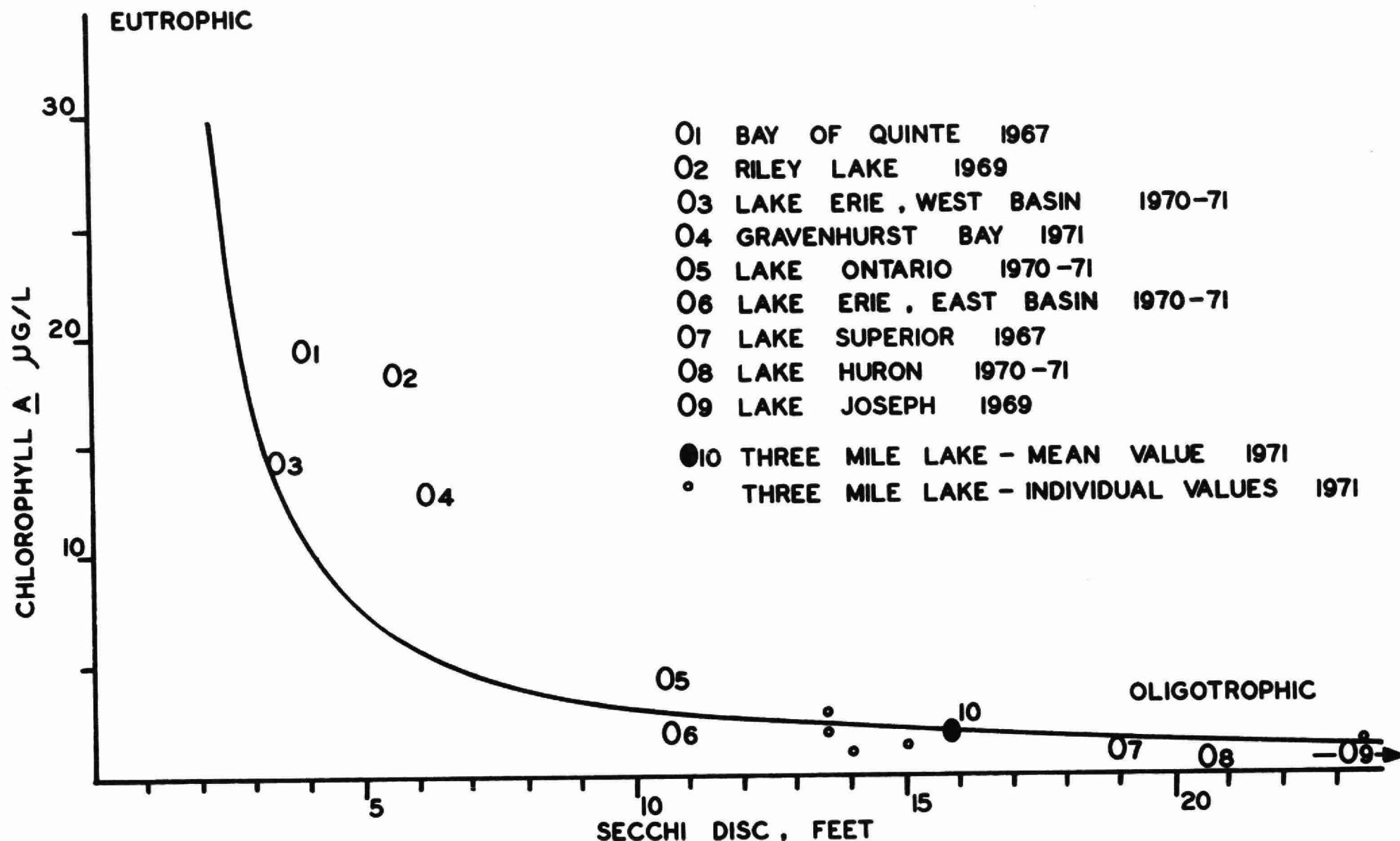


Figure 1: The relationship between chlorophyll a and Secchi disc as determined from Ontario Lakes surveyed in 1971. Individual chlorophyll a - Secchi disc values collected during 1971 on Three Mile Lake are presented.

The use of washing compounds containing phosphates should be avoided by residents. Most household liquid dishwashing products do not contain phosphates and therefore do not contribute to algal growth. If clothes washing is carried out at cottages, it is not necessary to use granular detergents containing phosphates, since ordinary soap products perform adequately in soft-water Pre-cambrian lakes. Although the phosphate content of all household detergents have been reduced to approximately 20% as P_2O_5 (effective August, 1970) and to less than 5% by the end of 1972, the exclusive use of laundry soaps would provide a significant reduction in the potential enrichment by phosphates.

<u>Date</u>	<u>Chlorophyll a</u>	<u>Secchi Disc</u>
August 3/71	1.8 µg/l	13.5'
August 8/71	1.3	14'
August 23/71	2.9	13.5'
September 6/71	1.1	23.5'
October 11/71	1.1	15'
<hr/>		
Mean	1.6	15.9'
<hr/>		

Table 1: Chlorophyll a concentrations (micrograms per litre) and Secchi disc values (feet) for Three Mile Lake during 1971.

GLOSSARY OF TERMS

- ALGAE** - An assemblage of simple, mostly microscopic non-vascular plants containing photosynthetic pigments such as chlorophyll. Algae occur suspended in water (phytoplankton) and attached to rock and other suitable substrates. Some algae may produce nuisance conditions when environmental parameters are suitable for prolific growth.
- CHLOROPHYLL** - the photosynthetic green pigment which occurs in all algal divisions.
- EUPHOTIC ZONE** - the lighted region that extends vertically from the water surface to the level at which photosynthesis fails to occur due to insufficient light penetration.
- EUTROPHIC** - waters containing advanced nutrient enrichment and characterized by a high rate of organic production.
- EUTROPHICATION** - the process of becoming increasingly enriched in nutrients. It refers to the entire complex of changes which accompanies increasing nutrient enrichment. The result is the production of dense nuisance growths of algae and aquatic weeds which generally degrade water quality and render the lake unsuitable for many recreational activities.
- MESOTROPHIC** - waters characterized by a moderate nutrient supply and organic production (i.e. midway between eutrophic and oligotrophic).
- OLIGOTROPHIC** - waters containing a small nutrient supply and consequently characterized by low rates of organic production.
- SECCHI DISC** - a circular metal plate, 20 centimeters in diameter, the upper surface of which is divided into four equal quadrants and so painted that two quadrants directly opposite each other are painted black and the intervening ones white. The Secchi disc is used to estimate the depth of the euphotic zone.

TROPHIC STATUS - depending upon the degree of nutrient enrichment and resulting biological productivity, lakes are generally classified into three intergrading types: oligotrophic, mesotrophic and eutrophic. If the supply of nutrients to an oligotrophic lake is progressively increased, the lake becomes more mesotrophic in character; with continued enrichment it will become eutrophic.

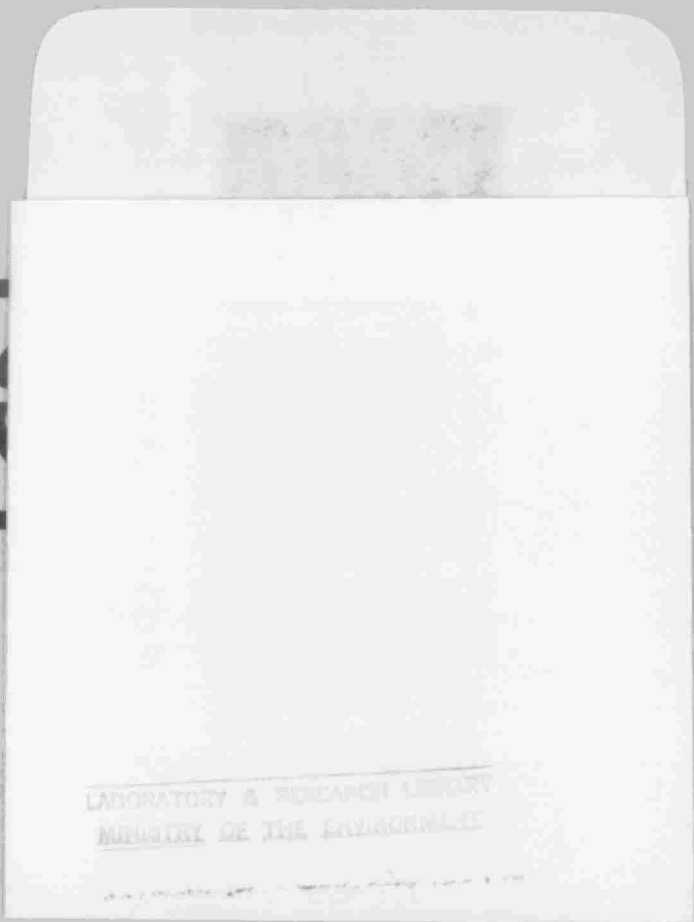
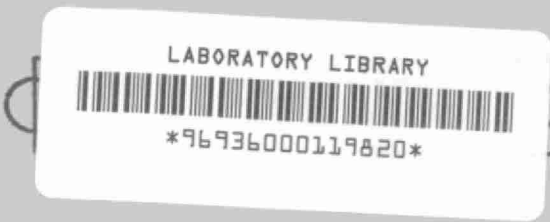
$\mu\text{g/l}$ - micrograms per litre or parts per billion.

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BROWN, D.J. (1972). Chlorophyll a - Secchi disc relationships in Ontario Recreational Lakes. (In preparation).

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